Medication use but not ADHD symptoms accounts for variance in EEG spectral slope in autistic children: Results from the Autism Biomarkers Consortium for Clinical Trials (ABC-CT)

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Background

- The slope of the electroencephalogram (EEG) power spectrum indexes the relative balance of cortical excitation and inhibition.
- Autistic children and children with attention-deficit/hyperactivity disorder (ADHD) have flatter spectral slopes, suggesting an altered excitation/inhibition (E/I) balance. [1,2]
- Stimulant and/or alpha agonist use is associated with changes in spectral slope in ADHD. [3]
- No studies have examined how medication use impacts spectral slope in autism.

Hypotheses

Increased ADHD symptomatology will be associated with flatter spectral slopes in autistic children, but this difference will be attenuated among those taking ADHD medication.

Methods

Autism Biomarkers Consortium for Clinical Trials

Lage (N = 399), multi-site study evaluating a battery of candidate EEG and eye-tracking measures in autistic and neurotypical children ages 6-11 across multiple timepoints.

Participants

	N (Male)	Age	IQ	CASI-5 ADHD
ASD	280 (215)	8.6 (1.6)	98.6 (18.1)	73.9 (13.3)

Independent Variables

- Child and Adolescent Symptom Inventory, Fifth Edition (CASI-5) Inattentive and Hyperactive/Impulsive subscales.
- Use of stimulant (St, n = 45) and alpha agonist (AA, n = 36) medications.

Dependent Variable

- Participants viewed non-social, abstract moving images for a total of 180 seconds.
- EEG data was recorded with a 128-electrode EGI HydroCel net.
- Slope was calculated by fitting a least-squares linear regression of log-transformed power as a function of frequency. [2]

Methods

Statistical Analyses

- Linear regressions to determine relationship between spectral slope, ADHD symptoms, and medication use.
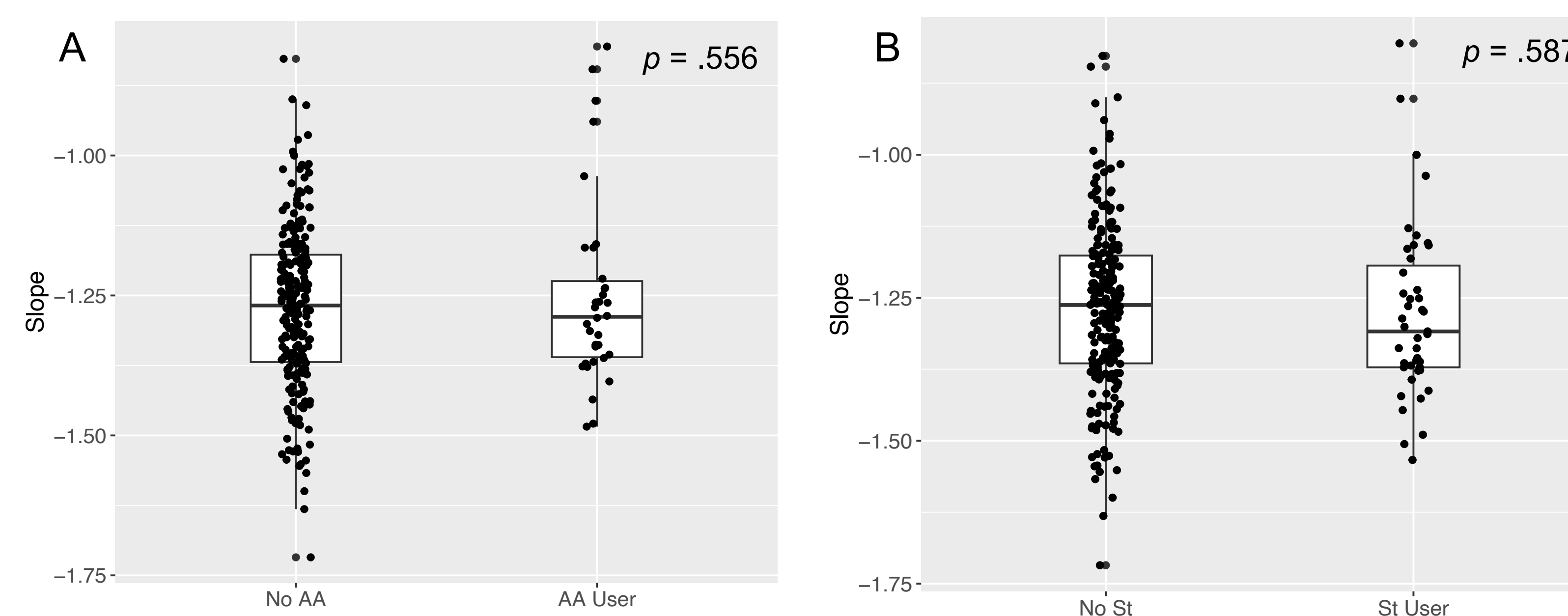- Relationships were confirmed with age and IQ as covariates.

Results

Figure 1. Slope did not differ in autistic children taking (A) AA and (B) St compared to those who were not.
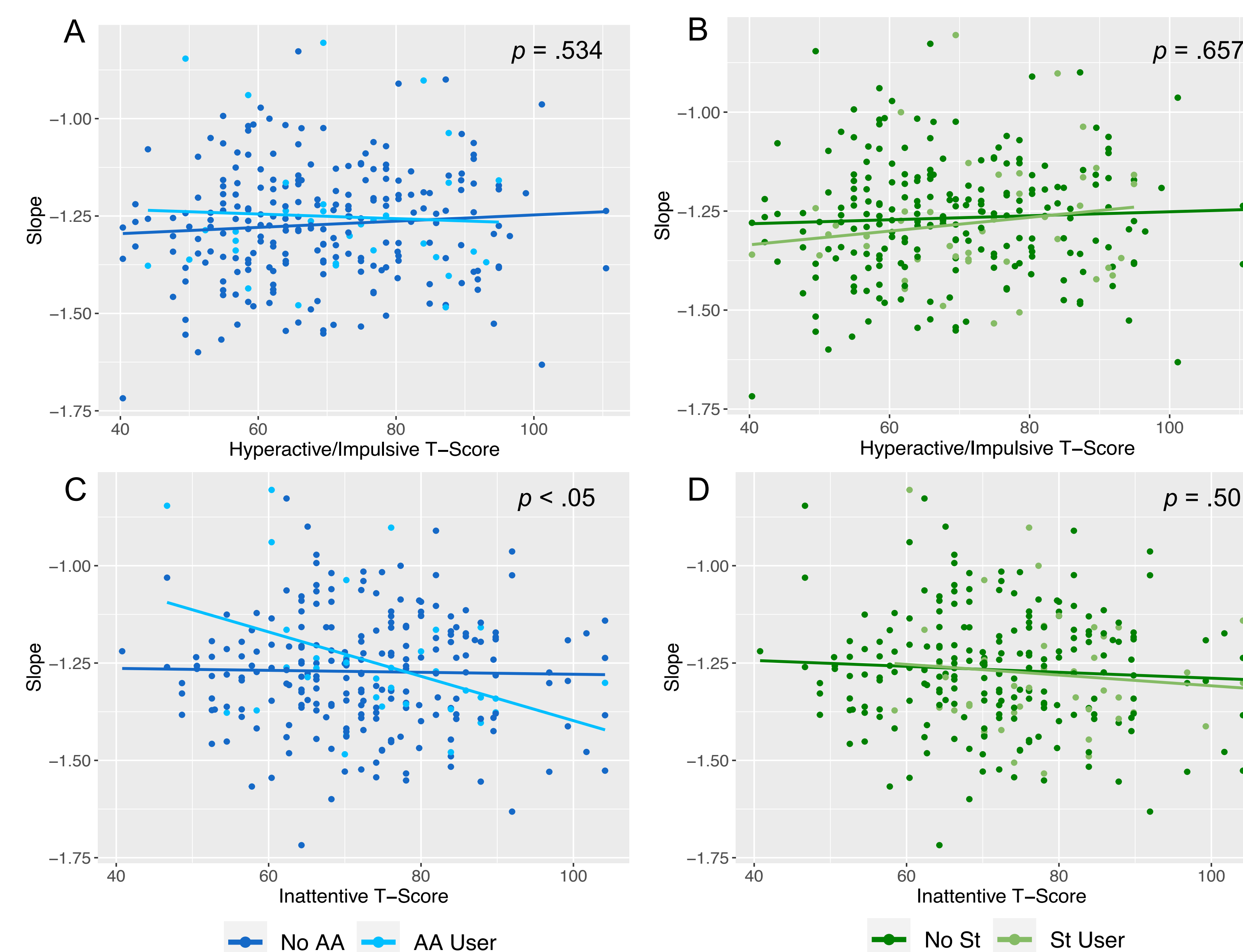

Figure 2. Relationship between hyperactive/impulse T-score and spectral slope, moderated by (A) AA and (B) St use; Relationship between inattentive T-score and slope, moderated by (C) AA and (D) St use.

Results

- Neither ADHD symptom subscale predicted spectral slope [hyperactive/impulsive: $F_{(1,256)} = .73$, $p = .395$; inattentive: $F_{(1,256)} = 2.30$, $p = .131$].
- AA and St use did not predict spectral slope [AA: $F_{(1, 258)} = .34$, $p = .556$; St: $F_{(1,258)} = .30$, $p = .587$].
- **Increased inattention symptoms were associated with steeper spectral slope in autistic children taking alpha agonists compared to those who were not.**

Conclusions

- There were no significant associations between ADHD symptom clusters and spectral slope in autistic children.
- Results did not support our hypothesis that ADHD symptomatology in autism is related to E/I balance indexed by spectral slope.
- Taking alpha agonists moderated the relationship between inattention and spectral slope, suggesting alpha agonists might have a specific impact on the spectral slope of autistic individuals with increased inattentive traits.
- Future studies should use a pre-post design to evaluate the effect of medication use on spectral slope.

References

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